DOCUMENT RESUME

ED 362 157 IR 016 313

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TITLE Preconceptions of Mediated Instruction for Various Domains of Learning Outcomes.
PUB DATE Jan 93
NOTE 12p.; In: Proceedings of Selected Research and Development Presentations at the Convention of the Association for Educational Communications and Technology Sponsored by the Research and Theory Division (15th, New Orleans, Louisiana, January 13-17, 1993); see IR 016 300.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Books; Comparative Analysis; Computer Assisted Instruction; *Difficulty Level; *Educational Media; Educational Television; Education Majors; Females; Higher Education; Interactive Video; Intermode Differences; Outcomes of Education; Preservice Teacher Education; *Student Attitudes; Undergraduate Students

ABSTRACT

This study examined the factors that contribute to learners' perceptions of the ease or difficulty of learning a specific task using a specific medium were studied, specifically whether the preconceptions of preservice teachers vary by learning domain (verbal, intellectual, affective, and psychomotor) or medium of presentation (interactive video, computers, television, and books). Forty-two female undergraduates rated the difficulty of learning through the four media and assessed preconceptions of the difficulty of each medium for each domain. Participants viewed the media as very different in their ease of learning, and considered that the ability of the medium to present actual models demonstrating the desired behavior was very important. (Contains 13 references.) (SLD)

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Title:

Preconceptions of Mediated Instruction For Various Domains of Learning Outcomes

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IR016313

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Preconceptions of Mediated Instruction for Various Domains of Learning Outcomes

Individuals involved in teaching and training are confronted with a vast array of potentially beneficial instructional media. Text, television, computers, and other media all promise to improve learner attention and achievement. Several researchers (Krendl & Watkins, 1983; Merikoff, 1980; Salomon, 1983; Salomon & Leigh, 1984) have suggested that learners' preconceptions of media are an influential factor in achievement. For example, Salomon (1984) found that learners perceive television as easier than books, yet they learn more from a text-based lesson. Salomon concluded that learners' perceptions of television as an easy medium resulted in a passive response toward learning from that medium and, thus, reduced achievement. The results of these studies have been assumed to apply to learning from computers (Dalton, 1986; Salomon & Gardner, 1986) and interactive video (Hannafin, Garhart, Rieber & Phillips, 1985; Schaffer & Hannafin, 1986); however, there is very little data that has explicitly examined learners' preconceptions of these newer media.

Although several versions of schema theory have been proposed to explain the relationship between learners' preconceptions of the ease of learning from a medium and their achievement, the construct of scripts proposed by Shank and Ableson (1977) may provide a reasonable explanation for this phenomena. As described by Schank and Ableson (1977) scripts guide information processing by prescribing appropriate sequences of actions in well known situations. The extent to which learners perceive a medium as easy or difficult may provide insight as to the nature of the scripts that are operating when attending to a lesson presented through that medium.

Although earlier research (Salomon,1983; Salomon, 1984; Salomon & Leigh, 1984; Krendl, 1986) found that learners' preconceptions of the ease or difficulty of learning a lesson depended on the medium of presentation, Beentjes (1989) found that students' ratings of the ease or difficulty of learning from a particular medium was strongly dependant on the topic of the lesson.

It is possible learners are aware that certain media are more effective than other media in facilitating the acquisition of certain learning outcomes. Gagne (1985) classified objectives as psychomotor skills, intellectual skills, verbal information, or affective learning, depending on the requirements of the task. Like many others, he proposed that the most effective medium for presentation is partially dependant on the desired learning outcome.

If students are somehow aware that one medium is more effective than others for the teaching of a given outcome, the differences in perceived difficulty observed by Beentjes (1989) may have been the result of the differences in learning domains represented by the topics on his questionnaire.

In Cennamo's (in press) investigation of learners' preconceptions of the ease of learning tasks representing various learning domains through the media of books, computers, television, and interactive video, she found that the symbol systems and processing capabilities represented by the media may have influenced learners' perceptions of the ease of the task. The students' ratings of the ease of learning various

tasks using interactive video, computers, television, and books seemed to reflect some awareness of the external conditions needed for optimal learning in each domain. Learners rated interactive video and television as the easiest from which to learn psychomotor skills. The learners' ratings of the ease of learning psychomotor skills from television and interactive video may have reflected an awareness that demonstrations are a valuable asset when learning psychomotor skills. Likewise, modelling is suggested as a condition which will facilitate the adoption of an attitude change, and television and interactive video, the two media where behavior can be most easily modeled, were rated as the easiest from which to learn attitude skills. On the other hand, practice and feedback are valuable conditions for the attainment of verbal information and intellectual skills, and the students rated computers and interactive video, the media which would most easily provide practice and feedback, as the easiest from which to learn these skills.

But what influences learners' preconceptions of media? Why do learners view one media as easier or more difficult than another for a particular task? This exploratory study attempted to address these questions.

Purpose of study. This study was conducted as an initial step in determining what factors which contribute to learners' preconceptions of the ease or difficulty of learning a specific task using a specific medium. It examined whether the preconceptions of pre-service teachers varied by learning domain (verbal, intellectual, affective, psychomotor) or medium of presentation (interactive video, computers, television, books). Information was collected as to why the students perceived one medium as easier or more difficult than another for a particular learning task in order to gain insight as to the factors that contributed to students' preconceptions of media.

Methods

In this exploratory study, undergraduate students were asked to complete a self-report questionnaire on their preconceptions of the difficulty of four media (books, television, computers, and interactive video) and to participate in an individual interview.

Participants

Forty-two undergraduate students enrolled in an education class in a large midwestern university participated in the study. All of the respondents were female. Approximately 75% were elementary education majors and 25% were interested in child and family services. Twelve respondents were randomly selected to participate in a follow-up interview to solicit information on factors that contributed to their perceptions of ease or difficulty.

Materials

The preconceptions questionnaire included a cover sheet that operationally defined each medium in order to ensure that all participants interpreted the terms "books" "television", "computers", and "interactive video" in the same manner. Information was collected on the frequency of use of each medium. The students were asked to rate the difficulty of learning 12 tasks using each of the four media on a five-point Likert scale. One represented "very easy" and five represented "very difficult".

The questions were similar in format to those used by Beentjes (1989) and Salomon (1984). Whereas Beentjes and Salomon ask the learners to respond to questions such as:

- How difficult would it be for you to learn to solve a math problem from a book?

- How difficult would it be for you to learn to solve a math problem from television?

This questionnaire included questions such as:

- How ease would it be to learn to open and maintain a checking account from

a book	*very easy*	1	2	3	4	5	*very difficult*
television	*very easy*	1	2	3	4	5	*very difficult*
a computer	*very easy*	1	2	3	4	5	*very difficult*
interactive video	*very easy*	1	2	3	4	5	*very difficult*

There were three questions for each learning domain (intellectual, verbal, psychomotor, and attitudes). The outcomes for each learning domain were selected from Dick and Carey (1990) and were assumed to fairly represent the type of task that would be classified within a particular learning domain. The questions included stems such as:

- How easy would it be to learn to change the tire on an automobile from... (psychomotor)

- How easy would it be to learn to choose to treat customers in a friendly, courteous manner from..... (attitude)

- How easy would it be to learn to label the parts of the human body using common terminology from ... (verbal information)

- How easy would it be to learn to open and maintain a checking account from... (intellectual skill)

Ratings were summed by medium and domain. Chronbach's alpha yielded an acceptable overall reliability coefficient of .87. Alpha coefficients for each media subscale are as follows: books, .83; television, .80; computers, .63; interactive video, .77. Alpha coefficients for each domain subscale were .72 for psychomotor, .83 for attitudes, .60 for intellectual skills, and .78 for verbal information.

Procedures:

During the seventh week of class, the participants completed a questionnaire assessing their preconceptions of the difficulty of each medium for each domain. The questionnaire was presented as a normal part of the class, and all students who were present completed the questionnaire. At this time, the researcher invited the participants to sign-up for an interview. Although the participants were offered a small amount of extra credit for participation in the interview, the structure of the course allowed the students to earn course credit in a variety of ways and they were offered the opportunity to participate in a variety of studies for credit throughout the semester.

Twelve students were randomly selected from the 26 students who volunteered to participate in the interview.

The students who were selected for individual interviews were asked to sign-up for an interview appointment. As they reported to the interview site, the interviewer explained the purpose of the interview and presented the participants with their previously completed questionnaires. For each task and medium, the interviewer read the question and the participants' responses aloud. The students were given the opportunity to change their responses, then asked to orally reflect on why they rated the medium as they did. These conversations were audiotaped and later transcribed.

Results

The data from the questionnaires were analyzed using a Repeated Measures Analysis of Variance to determine whether students preconceptions of the ease of learning a task varied by learning domain, by medium, or randomly depending on topic. The data from the interviews were entered into a database and sorted by question. The responses for each question were analyzed to determine trends in responses. The data analysis indicated several significant findings concerning learners' preconceptions of the ease of learning a given outcome using a given medium of presentation.

Analysis of Questionnaire Data

As expected, there was a significant difference among media, $F(1,41) = 18.6$, $p<.001$, and among learning domains, $F(1,41) = 9.41$, $p=.004$. Interactive video was perceived to be the easiest to learn from ($\underline{M} = 23.14$), and books were perceived to be hardest ($\underline{M} = 31.45$). Computers ($\underline{M} = 26.93$) were perceived to be easier than books and television, and television ($\underline{M} = 28.14$) was perceived to be easier than books. Students perceived that it was easier to learn verbal information ($\underline{M} = 24.93$) and attitudes ($\underline{M} = 26.50$) than intellectual ($\underline{M} = 28.50$) and psychomotor ($\underline{M} = 29.74$) skills.

Table 1. Means for media and domains

	Books	Television	Computers	IVD	Domain Total
Psychomotor	9.64	6.05	8.24	5.81	29.74
Attitude	7.79	5.45	7.52	5.74	26.50
Intellectual	7.19	8.69	6.36	6.26	28.50
Verbal	6.83	7.95	4.81	5.33	24.93
Media Total	31.45	28.14	26.93	23.14	

Note: n = 42

As expected, there was also a significant interaction among learning domain and medium, $F(1, 41) = 35.54$, $p < .001$. Learners perceived that it was easier to learn psychomotor skills from television ($M = 6.05$) and interactive video ($M = 5.81$) than from computers ($M = 8.24$) and books ($M = 9.64$). For the learning of attitudes, learners also perceived it to be easier to learn from television ($M = 5.45$) and interactive video ($M = 5.74$) than from computers ($M = 7.52$) and books ($M = 7.79$). Learners perceived it to be easier to learn intellectual skills from interactive video ($M = 6.26$) and computers ($M = 6.36$) than from books ($M = 7.19$) and television ($M = 8.69$). The same trend continued for learning verbal information: Computers ($M = 4.81$) and interactive video ($M = 5.33$) were rated easier than books ($M = 6.83$) and television ($M = 7.95$).

In examining the means by medium, the results indicate that it is perceived to be easiest to learn verbal information from books ($M = 6.83$), followed by intellectual skills ($M = 7.19$), attitudes ($M = 7.79$), and psychomotor skills ($M = 9.64$). For television, it is perceived to be easiest to learn attitudes ($M = 5.45$), followed by psychomotor skills ($M = 6.05$), verbal information ($M = 7.95$), and intellectual skills ($M = 8.69$). It is perceived to be easiest to learn verbal information from computers ($M = 4.81$), followed by intellectual skills ($M = 6.36$), attitudes ($M = 7.53$), and psychomotor skills ($M = 8.24$). For interactive video, the learners perceive it to be easier to learn verbal information ($M = 5.33$), followed by attitudes ($M = 5.74$), psychomotor skills ($M = 5.81$), then intellectual skills ($M = 6.26$).

Analysis of Interview Data

The frequently listed responses were sorted into several categories. The majority of the responses referred to the symbol systems offered by the various media. Participants mentioned the presence or absence of pictures, graphics, live demonstrations, moving images, and related symbols. The second most frequently mentioned category of responses referred to the processing capabilities offered by the media. Responses in this category referred to the ability of the media to present questions, ease of reviewing information, option of controlling the pace of the presentation, possibility for practice with feedback, and similar responses. The third most frequently mentioned category of responses involved the learners' preferences for certain media. Responses in this category included the learners' familiarity with learning a particular task with a particular medium, the extent to which they found presentations using a certain media interesting, and other personal preferences. Other responses mentioned the physical limitations of the technology. Participants mentioned the portable nature of books, the fact that videotapes could be shown at certain locations, and the accessibility of computers and books. A few participants referred to characteristics of the task when asked why they rated a particular medium they way they did for a particular task. These responses referred to the perceived ease or difficulty of the task in question.

Based on the results of the statistical analysis, the interview data was interpreted in terms of the media by domain interaction. Only those responses that were mentioned by five or more participants will be included in the following discussion. Some of the participants responded that computers or interactive video were "like books" or "like television", but provided no other reasons for their responses. Due to the lack of relevant information in these responses, they will not be included in the analysis. (See Table 2)

Table 2: Table of responses mentioned by five or more participants

Attitude Skills	
Books	
self-paced, can skim, can review	9
Boring	8
easy task	6
Television	
see how to do, demo	11
see it modeled	8
interesting, entertaining	5
Computers	
same as books	12
graphics and pictures	5
read and follow steps	5
interesting and gains attention	5
no live demos	5
Interactive Video	
same as TV	12
demonstrations, person models	11
questions, participate, interactive	7
visuals	5
involvement, questions, exercises	6
TV and computer	5
demonstrate steps	5
like TV	5

Verbal information	
Books	
labels, diagrams, pictures	12
facilitate memorization	8
familiar	6
Television	
show instead of tell, point out things	11
pace	10
visualize/ see it	5
need interaction & hands on	5
Computers	
show pictures with labels	11
interaction & quizzes	10
like books	9
hands-on	9
Interactive Video	
Quiz/ interaction	6

Intellectual skills	
Books	
task easy (or hard)	12
familiar	12
telling what to do, directions	5
Television	
lack of interaction, just watch	10
set pace & can't review	8
someone just tells you	6
Computers	
Like books	12
practice problems and questions	7
step-by-step	7
hands-on involvement	5
Interactive Video	
watch someone	7

Psychomotor Skills	
Books	
Lack of demo, can't see it done	11
step-by step instructions	7
Television	
see it done	29
can model	7
Computers	
not real pictures	8
graphics & animation	6
like books	8
Interactive Video	
moving images and sound	8
control of pace & review	7
see someone doing it/ demo	7
like TV	7
questions and quizzes	5

Psychomotor skills. When learning psychomotor skills, the participants felt it was important to be able to see the skill demonstrated. This characteristic was the most frequently cited reason for rating television and interactive video as easy, and most frequently cited reason for rating books as a difficult medium from which to learn psychomotor skills. In examining the responses to the question on psychomotor skills mentioned by five or more participants, the vast majority of the responses referred to the symbol systems offered by the media in question. Interactive video was the only medium for which there were frequent responses mentioning any other category. The processing options available through the medium of interactive video were perceived as a positive addition to the ability to view actual demonstrations. Several respondents mentioned that interactive video would allow them to answer questions, review the content, and control the pace of the presentation.

Verbal information. When learning verbal information, the participants felt that the processing capabilities offered by the media were at least as important as the symbol systems. The ability of computers and interactive video to provide hands-on interaction in the way of practice questions and feedback was mentioned quite frequently as a reason for the perceived ease of these two media. Conversely, the lack of learner control over the pace of a television program was mentioned most frequently as a reason why television was rated as a difficult medium from which to learn verbal information. The symbol systems offered by the media were also important. Pictures with labels were viewed as positive features of computers and books, and the fact that someone was simply "telling" you information was viewed as a negative aspect of television. Respondents also mentioned that they were familiar with learning verbal information from books and that they felt the format of books facilitated memorization of verbal information.

Attitude skills. The ability of a medium to present a live model demonstrating the desired behavior was viewed as the most important characteristic for increasing the ease of learning an attitude. This ability was seen as a positive characteristic of television and interactive video and the lack of such ability was seen as a negative characteristic of computers. The ability of a medium to provide visuals, graphics and pictures was also perceived to facilitate the ease of learning attitudes. Learner preferences also were viewed as very important in the ease of learning attitudes. The participants frequently mentioned that learning an attitude from television and computers would be interesting and entertaining, yet learning attitude skills from books would be boring. However, the self-paced nature of books was viewed as a positive characteristic in learning attitudes from books. Respondents liked the fact that they could skim over sections or review sections when they desired. Other individuals mentioned that the ease of learning an attitude from books was determined by the ease or difficulty of the task they were to learn.

Intellectual skills. Processing capabilities were viewed as important characteristics for facilitating the ease of learning an intellectual skill. The ability of computers and interactive video to provide practice questions and hands-on involvement in the learning of intellectual skills were frequently mentioned responses. Conversely, the lack of hands-on involvement was seen as a characteristic which made it more difficult to learn intellectual skills from television. The lack of learner control over the pace of television and the lack of the option of reviewing information were frequently given as reasons that participants rated television as a difficult medium from which to learn intellectual skills. Responses which mentioned the symbol systems offered by the respective media were the next most frequently mentioned category. The ability of computers and interactive video to demonstrate the skill in a step-by-step manner was

perceived as important in facilitating the ease of learning intellectual skills. Although the ability to watch someone perform the skill was perceived as a positive characteristic when coupled with the processing capabilities of interactive video, the fact that someone "just tells you" how to do the skill was viewed as a negative characteristic of television. For the medium of books, the most frequent responses fell into the categories of characteristics of the task and learner preferences. The ease or difficulty of the task were frequently mentioned as reasons for participants' ratings of the ease or difficulty of learning from books. Just as frequently, participants mentioned their familarity with learning from books as a reason for their responses.

Discussion

The purpose of this study was to determine factors which contribute to learners' preconceptions of the ease or difficulty of learning a specific task using a specific medium. Participants completed a self-report questionnaire assessing their preconceptions of the ease of achieving various learning outcomes (psychomotor, affective, verbal, intellectual) using the media of interactive video, computers, books, and television, and participated in individual interviews in which they were asked to verbally reflect on their responses to the questionnaire.

The results of this study indicated that the participants viewed interactive video, computers, television, and books as very different in their ease of learning. Contrary to previous research (Krendl, 1986; Salomon, 1984; Salomon & Leigh, 1984), the participants did not consistently rate books as the most difficult medium. Instead, there was a strong interaction among the medium of presentation and the learning domain of the intended outcome. An analysis of the interview responses indicated that for different domains of learning outcomes, learners use different criteria for rating a medium as easy or difficult.

The participants indicated that for learning attitudes, the ability of a medium to present actual models demonstrating the desired behavior was an important factor in contributing to the ease of learning from a medium. Therefore, it is not surprising that television and interactive video are rated as the easiest media from which to learn attitude skills. Learners' personal preferences also seem to play a part in the perceived ease of learning an attitude from a given medium; the participants indicated that it would be boring to learn an attitude from books, while it would be interesting and entertaining to learn the same type of skill from television.

The ability of a medium to present an actual demonstration of the target skill was also an important factor in the participants' ratings of the perceived ease of learning a psychomotor skill, thus, they rated interactive video and television as the easiest media from which to learn this type of skill. In addition, the participants perceived that the added processing capabilities of interactive video which allow them to control the pace of the presentation, respond to questions, and review sections would further contribute to the ease of learning a psychomotor skill.

For the learning of verbal information and intellectual skills, the participants indicated that the processing capabilities of a medium would greatly contribute to the ease of learning from that medium. The ability of computers and interactive video to provide the learners with hands-on practice of the target skills was viewed as an important factor in their ratings of these media. In addition, the symbol systems offered by the media were mentioned as influential factors in their ratings. The presence of pictures with labels was mentioned frequently as an important factor in learning verbal

information and the step-by-step demonstration of an intellectual skill was mentioned frequently as an influential factor which contributed to their perceptions of the ease of learning an intellectual skill.

It is interesting to note that learner preferences and task characteristics were frequently cited as reasons for the participants' ratings of the ease of learning from books. They frequently mentioned that they were familiar with learning a particular skill from books. In addition, the perceived ease or difficulty of the task itself was mentioned frequently as a reason for their ratings. It appears that the symbol systems and processing capabilities of books are less important factors in the participants' ratings of this medium than in their ratings of television, computers, and interactive video. Although the participants may be less familiar with computers and interactive video than books, they are assumed to be very familiar with television. However, their responses indicate that they may be more familiar with receiving instruction through books than through the other three media.

Although the commonly accepted viewpoint is that "...media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes chance in our nutrition" (Clark, 1983, p. 445), Kozma (1991) has challenged and expanded this commonly held view and proposed that the "capabilities of a particular medium, in conjunction with methods that take advantage of these capabilities, interact with and influence the ways learners represent and process information and may result in more or different learning when one medium is compared to another for certain learners and tasks " (p. 179). Kozma goes on to say "Whether or not a medium's capabilities make a difference in learning depends on how they correspond to the particular learning situation- the tasks and learners involved- and the way the medium's capabilities are used by the instructional design." (p. 182)

The results of this study suggest that learners' perceptions of the ease of learning a particular task using a particular medium are strongly influenced by the capabilities of the medium such as it's symbol systems and processing capabilities. In addition, their preconceptions are also influenced by characteristics of the learner and the characteristics of the task. Although this study has not attempted to determine which medium actually facilitated the ease of learning a particular task, it has attempted to determine what factors contribute to learners' preconceptions of the ease of learning a given task from a given instructional delivery system. Future research should continue to explore the relationship between learners' preconceptions of a medium and their actual achievement when learning from that medium.

It is important to recognize that this exploratory study has been conducted with a small number of female undergraduate education students. It is possible that, due to the past experience and academic major of this group, this population has an enhanced awareness of effective teaching/learning strategies that may not be present in the general adult population. Future research is needed to determine to what extent the findings of this exploratory study apply to the general adult population.

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